Japan, and, I may add, the West Indies, it would appear that the crust of the globe is practically in a constant state of tremor. The variations in these movements are more law-abiding than the large earth movements, and they show a direct relationship to barometric fluctuation.

Their relationship to many other telluric and atmospheric phenomena, together with their cause, has yet to be discovered. As every one has the opportunity to observe these phenomena, they call for attention. Just as a turbulent sea outraces a coming typhoon and gives mariners warning of approaching danger, it is possible that these microscopic disturbances of the soil may hold connection with subsequent phenomena, and lead us by their study to the better understanding of the complexity of phenomena with which we are surrounded.

Tokio, Japan JOHN MILNE

THE MECHANICAL THEORY OF MAGNETISM

IF Prof. Hughes were as great a master of writing English as he is of experimenting, his views on magnetism would receive speedier acceptation, for they would then probably be understood without that close study which his involved sentences and heterogeneous paragraphs now demand. It is very remarkable that such an ardent worker, such a deep thinker, and such a clear and simple experimenter should have such difficulty in expounding his views on paper. His experimental demonstrations are always clear and convincing, his recent lecture at the Royal Institution appealed to every degree of intelligence present, but his papers at the Royal Society want some strong external directing influence to render their meaning evident.

What is magnetism, according to this expert philosopher? It is an inherent quality of the molecules of matter, as determined and constant as that of their gravity, affinity, or cohesion, and like these qualities it differs in degree with every kind of matter. He does not attempt at present to define it closer than this. We cannot tell what gravity is, neither need we say what magnetism is. All Prof. Hughes says is that every molecule in nature is a little magnet imbued with a certain polarity varying in degree but constant for each substance, in virtue of which it has a north and a south pole along the same axis, and that the only change that takes place is a change in the direction of this polar axis. When these molecules are symmetrically arranged by some external directing influence, so that all their poles lie in the same direction, we have *evident magnetism*. Iron becomes a magnet in virtue of the fact that its molecules are free to move under the influence of external magnetic action, while copper is not a magnet because its molecules are immovable and irresponsive to the same cause. Steel becomes permanently magnetised because its molecules are rigid, and retain the axial direction impressed upon them. Soft iron is readily demagnetised because its molecules have great freedom of motion. Coercive force is therefore simply absence of freedom of molecular motion—it is, indeed, molecular rigidity. The extent to which the axis of polarity can be deflected from its normal direction is its *point of saturation*.

Evident magnetism is the symmetrical arrangement of the polarised molecules along one line; *neutrality* is symmetrical arrangement of the same molecules in closed curves. In both cases the sum of the magnetic influence of all the molecules is the same; but in evident magnetism it is directed outwards, in neutrality it is directed inwards. Remaining magnetism is partial neutrality. The experimental way in which Prof. Hughes demonstrated these conclusions is the most beautiful investigation he has yet made. He proves the existence of the same polarity in the atmosphere and in the ether, and he attributes diamagnetic effects to the higher magnetic capacity of the ether than of the substances suspended in it. It is therefore a differential action. Molecules, moreover, have inertia—they resist being put in motion; and when in motion they resist stoppage—they possess momentum. The direction of the axis of polarity can be displaced by the physical forces, such as mechanical stress, heat, or electricity. He shows that mechanical motion, heat, and electricity are of similar kind—they are vibratory, or some mode of motion. Magnetism, however, he considers not to be a mode of motion, and therefore it is not a physical force. It is simply an arrangement of the molecules of matter in symmetry or dissymmetry under the influence of some physical force. He seems to imply, though he does not directly say so, that the influence of electric currents upon magnets is not due to any direct action between them, but to the fact that the currents have polarised the ether in which both are suspended.

His views are very broad and highly suggestive, but there are some points that are not clear and that demand further elucidation. Why, for instance, does mechanical elongation and contraction take place when bars of iron are magnetised and demagnetised? How can heat and strong sonorous vibrations be produced unless there be a considerable expenditure of energy? How does he account for the attractive and repulsive properties of magnets, and for magnetic induction? He has certainly wrested magnetism from the realms of hypothesis and brought it within the domain of theory. The days of Coulomb and Poisson's fluids and Ampère's elementary currents of electricity are over; the molecular character of magnetism is experimentally established; but what is a molecule, and how becomes it polarised unless it be in rotation? How does the external directing influence act? We are also inclined to ask, Has Prof. Hughes sufficiently grasped Ampère's theory? It was purely mathematical, based on the assumption of the circulation of currents around each molecule. He goes no further than Ampère did, for he has not answered the question, What is polarity? In fact his polarised molecules are all little magnets, and no theory of magnetism will be complete until it explains these little magnets. Thus the difference between Ampère and Hughes is the difference between a current and a magnet.

However, on the assumption that a molecule is a magnet, Prof. Hughes has built up a very complete theory, which he has demonstrated experimentally in a way that places him in the very front rank of experimental philosophers.

NOTES

THE number of candidates up this session for the Fellowship of the Royal Society is sixty-seven.

WE understand that Sir Joseph Hooker has been nominated one of the vice-presidents for the Montreal meeting of the British Association. Instead of Mr. Crookes, Prof. W. G. Adams will give one of the public lectures. For the reduction of the fares of members the sum of 14,000 dollars has been allotted, only those elected at or before the Southampton meeting being entitled to share in the subsidy. This is in addition to the liberal reductions that will be made by the steamship and railway companies. All the American railways will reduce their fares by one-half. The American Association, which meets at Philadelphia on September 3, has given a cordial invitation to the Montreal visitors to take part in its meetings and excursions. Those wishing to share in the subsidy of 14,000 dollars must apply before September 25. For the Aberdeen meeting in 1885, Sir Lyon Playfair will be proposed as president. A well-attended meeting of the Organising Committee of the Chemical Section has been held under the presidency of Prof. Roscoe. Promises of papers were received from several well-known chemists, and a small executive committee was formed to draw up a list of papers and to communicate with Canadian and American chemists. Section G has been particularly active. The Committee has prepared a list of subjects for papers which it is thought would be interesting to English visitors if treated by engineers and mechanicians in Canada; a good supply of papers is expected both from this country and America. We regret to learn that Prof. Williamson, the General Treasurer, will be unable to be present, and the Council have decided to engage the services, *pro hac vice*, of Mr. Hamy Brown, Assistant Secretary and Accountant of University College, as "Financial Officer," while Prof. Burdon Sanderson has virtually consented to act as deputy for the Treasurer at Montreal.

M. CARO, for the French Academy, and MM. Pasteur and d'Abbadie, for the Academy of Sciences, will attend as delegates the *fêtes* at Edinburgh in commemoration of the tercentenary of the foundation of the University of Edinburgh.

DR. KOCH and his colleagues of the German Cholera Commission will proceed shortly to Goalpara and Darjeeling to prosecute further inquiries. After passing a few days there, they will return to Germany, but they hope to be back in India next winter to carry on their very important and useful labours.

DR. GEORGE ENGELMANN of St. Louis—the oldest United States botanist (excepting the venerable Lesquereux), as well as an eminent physician, for a time a fellow-student with Agassiz in Germany—died on February 11, at the age of seventy-five.

COMMODORE SAMUEL R. FRANKLIN, U.S.N., has been detached from duty on the United States Naval Examining Board, and ordered as superintendent of the naval observatory, to succeed Rear-Admiral R. W. Shufeldt, who was placed upon the retired list on February 21.

AT the sitting of the Academy of Sciences of March 10 M. Faye presented drawings which have been executed at Algiers by M. Trépied, Director of the Observatory, and which represent Pons' comet as seen on the very days on which have been noticed the changes that have excited such surprise amongst certain astronomers. M. Faye took advantage of this communication to give an explanation of these wonderful observations, which are more frequent than has been supposed in the history of astronomy. M. Faye does not suppose that they may be attributed to any collision with cosmical matter, but to a rapid change in the point of view of the comet itself, as observed from the earth. This theory will be illustrated by a woodcut published in the next number of the *Comptes Rendus*.

CONSIDERABLE progress has now been made in the carrying out of the works connected with the marine station which some time ago the Scottish Meteorological Society resolved to establish at Granton; and it is anticipated that the operations of the station will be properly commenced towards the close of the present month. As the first instalment of the work to be done, it is hoped that a tolerably complete description of the Firth of Forth, in its biological, meteorological, physical, and chemical relations, may be prepared in the course of the next few years; and when this has been carried out, the result will have an exceptional, and indeed unique value, as a piece of work of the greatest scientific and national importance, produced by cooperation amongst scientific men. The Council of the Scottish Meteorological Society, it may be mentioned, recently asked Her Majesty's Government for a subscription of 1000*l*. for the purpose of building permanent laboratories in connection with the station—undertaking at the same time to raise an additional 1000*l*. by public subscription. The Government, however, have not seen their way to assist this school of research, notwithstanding that the grant was warmly recommended by Prof. Huxley, President of the Royal Society. The Council of the Meteorological Society have, however, every confidence that the scheme will be liberally supported by the general public.

DR. CASEY, F.R.S., has just written a new work on Analytic Geometry, which covers about two-thirds of the ground occupied by Salmon's Conics; in the author's opinion it will contain more new matter than any work on the subject since Salmon's book was written.

AN interesting experiment is to be made by Dr. Zintgraff, who, in company with Dr. Chavanne, is about to visit the Congo and the interior of Africa. He takes with him a phonograph, wherewith to fix the speech and melodies of hitherto unknown tribes, which, thus received by the instrument, will be forwarded to scientific men in Germany. The apparatus (which will be used for such a purpose for the first time) has been made by Mr. Fuhrmann, of Berlin, and exactly corresponds with one he has in that city, so that the plates used in Africa can be sent to Berlin to be unrolled by that machine, and caused to re-emit the sounds received.

A REMARKABLE occurrence is reported from Bona (Algeria). An isolated mountain, Jebel Naiba, 800 m. in height, is rapidly decreasing in altitude, and round its base a considerable cavity is being formed. The whole mass of the mountain is evidently sinking. The neighbourhood of Bona must, however, have already been the scene of a similar phenomenon. Lake Fezzara, which measures over 12,000 hectares in extent, did not exist during the time of the Romans. Its depth in the centre is only 2·60 m. Investigations which were made in 1870 showed that the remains of a Roman town now lie in the lake; this town has therefore probably sunk in the same manner as the mountain.

A PREHISTORIC burial-ground has been discovered on the so-called Hasenburg, near Buhla (Kreis Nordhausen, Germany). Two complete human skeletons, numerous bronze rings, and several rings made of amber were found. The Hasenburg is an isolated rock on which stood formerly a castle of the Emperor Henry IV.; but the numerous prehistoric remains found in the neighbourhood point to its having been an ancient place of worship. The objects recently found have been deposited in the Museum of Nordhausen.

THE appointment by the Swedish Government of an entomologist to assist farmers has been found of so much value that it has been decided to continue the same. Dr. A. Holmgren has been appointed agricultural entomologist for this year.

THE city of Hamburg offers various prizes for the plans of a new Natural History Museum. The total cost of construction of the building must not exceed 45,000*l*. Five prizes of 50*l*. each will be awarded for the five best plans; further prizes of 200*l*. will be distributed amongst the victors for further work in connection with the scheme.

AT a recent meeting of the Straits Branch of the Royal Asiatic Society at Singapore, it was decided to prepare and publish a school geography of the Malay peninsula and the adjoining regions, as well as a skeleton map of the peninsula, on a scale of a quarter of an inch to a mile, to be gradually filled in as may be determined by subsequent survey and research.

DR. BENJAMIN SHARP has been appointed Professor of Lower Invertebrata by the Council of the Academy of Natural Sciences of Philadelphia. Dr. Sharp is a graduate of the University of Pennsylvania, from which he received the degrees of Doctor of Medicine and Doctor of Philosophy in 1881. He afterwards studied under Leuckart in Leipzig, and under Semper in the University of Wurzburg. Dr. Sharp was granted the privilege of studying at the Bavarian table in the Zoological Station at Naples, an honour rarely granted a foreigner. Dr. Sharp proposes delivering lectures, during the coming spring, on the lower forms of life.

PROF. KARPINSKY points out, in the *Memoirs of the St. Petersburg Society of Naturalists* (vol. xiii.), the following interesting feature of the geological structure of Russia. The unmetamorphosed rocks in Russia appear mostly quite, or nearly quite, undisturbed and horizontal. There is, however, besides the Crimea, a region where some dislocation and disturbance of these deposits are apparent. This disturbed region runs from north-west to south-east, through the Sandomir ridge in Poland to Kaneff in Kiev, Isakchi in Poltava, the coal-basin of the Don, the Bogdo Mountains of the Astrakhan Steppe, and finally to the Kara-tan and Ak-tan Mountains to the east of the Caspian. Beyond this region even the older deposits (Silurian and Devonian) remain undisturbed, while within it the older gneisses and crystalline schists are disturbed, not only by the Silurian upheaval which has had a direction from north-east to south-west, but also by the more recent one just referred to, which has a direction perpendicular to it. It is worthy of notice that this line of upheaval would join that line of ridges which runs in Western Europe through the mountains of the Weser and the Teutoburger Wald, while in Asia it would join the Sheikh-jeli and Uiz-Dagh Mountains.

WE notice in the same serial some very valuable observations of Prof. Beketoff about Dr. Sachs' theory as to the relations between the increase and segmentation of cells in the embryonal parts of plants. While he warns one against the application of geometrical theories to botany, he points out how some of the conclusions arrived at by Dr. Sachs could be more easily explained by the principles established by Wilhelm Hofmeister. Prof. Borodin's researches into the anatomy of the leaves of *Chrysosplenium* were made on very rich material collected by Prof. C. Maximowicz for his "Adumbratio Generis Chrysosplenii," and Prof. Borodin was enabled not only to thoroughly study the subject, but also to arrive at some most valuable conclusions as to the relations between the anatomical features of different species of this genus and the features on which the classification of these species has been made.

TRACES of glaciation in Siberia, so boldly denied a few years ago, have been discovered in different parts of the country. While failing to detect them on the outer parts of the Altai Mountains, M. Sokoloff has found unmistakable traces of an incomparably wider extension of glaciers in the central parts of the ridge, and especially in the Katun Mountains. Numerous traces have also been found, pointing to a greater extension of lakes during the post-Glacial period, and to the gradual drying up of the existing ones.

IN a paper recently published in the *Mémoires de l'Académie des Sciences de St. Pétersbourg* for 1883, Prof. Fr. Schmidt, while fully agreeing with the remarkable results of Mr. Walcott's researches as to the feet and respiratory organs of Trilobites (published in 1881 in the *Bulletin of the Harvard College Museum*), proposes to include in Mr. Walcott's second group of *Paleadæ* his own family of *Hemiaspidæ*. It consists of the genera *Hemiaspis*, Woodw., *Bunodes*, Eichw., and *Pseudoniscus*, Nieszk., which are much like Trilobites, but differ from them in the separate and freely-moving posterior parts of the body; formerly it was included in the group of Eurypterides.

PROF. TARKHANOFF contributes to the last volume of the *Memoirs* (*Trudy*) *of the Society of Naturalists of St. Petersburg* a very interesting inquiry into the structure of the eggs of birds. He has discovered that the albumen of the eggs of the *Insessores* (ousel, canary, pigeon, &c.) notably differs from that of the Autophagous birds (hens, ducks, geese, turkeys). When boiled it remains translucid; it is fluorescent; its rotation-power of the plane of polarisation is feebler; when diluted with much water it does not give a white deposit, but only gives a feeble opalescent coloration to the water; finally, it has a stronger basic reaction than the white of the eggs of the hen. It may, however, be transformed so as to become like it by various means, namely: the addition of neutral salts, or of bases, or of concentrated acetic and lactic acids, or even of carbonic acid. The most remarkable fact however is that the same result is also arrived at by incubation, and Prof. Tarkhanoff considers that the modifying agency in this case is the yolk; when moderately heated with yolk in closed vessels, during twenty-four hours or more, it is transformed into albumen like that of a hen's egg. As to the manner in which the yolk acts on it, it still remains unsettled; the supposition that the diffusion of salts is the cause of the change proved not to be true; and the cause must be searched for perhaps in the diffusion of gases. The interesting question, as to the albumen of hen's eggs not also undergoing the same stages of development within the ovarium, cannot yet be solved satisfactorily; but during his experiences M. Tarkhanoff observed once the most interesting fact that a small ball of amber introduced into the upper part of the ovarium occasioned the deposition around the ball of albumen and the formation of a shell, that is, the formation of a quite normal egg with its *chalazæ*, and other particularities of structure; this observation would thus strongly support the mechanical theory of the formation of the parts of an egg around its yolk.

DR. KING, retired Professor of Mineralogy, Geology, and Natural History in Queen's College, Galway, has lately been elected a Corresponding Member of the New York Academy of Sciences.

MR. E. L. LAYARD writes to us from Noumea, New Caledonia, under date Jan. 6, that the sunsets there have been quite as extraordinary as elsewhere. "As soon," he says, "as the sun's disk has disappeared, a glow comes up from the west like that of white-hot steel, reddening somewhat as it mounts to the zenith, but changing the while to blue. From the zenith it passes into the most exquisite green, deepening as it loses itself in the east. As the sun sinks lower and lower, the red tints overpower the white-hot steel tints, and the blue of the zenith those of the green. At 7 p.m., or a little after, nearly the entire western half of the horizon has changed to a fiery crimson; as time goes on, the northern and southern areas lose their glory, and the grays of night contract, from the northern end first, most rapidly; the east is of the normal gray. The south now closes in, and presently, about 8 p.m., there is only a glare in the sky, just over the sun's path as of a distant conflagration, 'till the fire in the west fades out.' I have been attempting to describe one of our cloudless evenings, of which we have had only too many, having just come through a fearful drought that has lasted all this while; but who shall paint the glory of the heavens when flecked with clouds! Burnished gold, copper, brass, silver—such as Turner in his wildest dreams never saw! and of such fantastic forms! The wonderful light from above was reflected on every tree and flower; our scarlet and crimson geraniums, fuchsias, &c., blazed in the light as I never saw them before, and the general effect was most extraordinary."

THE Cremation Society of Berlin now numbers 365 members, no less than 146 having joined the Society during 1883. The cremation movement is also progressing favourably at Hamburg, Königsberg, Dresden, Breslau, and Wiesbaden. At Gotha forty-six bodies were cremated during 1883, which is about double the number of those burnt in any of the four preceding years.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus* ♀) from India, a Pig-tailed Monkey (*Macacus nemestrinus* ♀) from Java, presented by Mr. G. H. Lee; two Herring Gulls (*Larus argentatus*), European, presented by Madam Fridaich; a Kagu (*Rhino-*

chetus jubatus) from New Caledonia, presented by Mons. J. M. Cornely, C.M.Z.S.; four Blue Titmice (*Parus cœruleus*), British, presented by Mr. Hanaeur; a Barn Owl (*Strix flammea*), British, presented by Mrs. W. Gittens; a Rhesus Monkey (*Macacus rhesus* ♂) from India, deposited; a Bosman's Potto (*Perodicticus potto*) from West Africa, purchased; a Yellow-billed Duck (*Anas xanthorhyncha*) from South Africa, received in exchange; a Bengalese Cat (*Felis bengalensis*) from India, received on approval; a Zebu (*Bos indicus* ♂), a Collared Fruit Bat (*Cynonycteris collaris*), an Emu (*Dromæus novæ-hollandiæ*), bred in the Gardens.

GEOGRAPHICAL NOTES

ALTHOUGH the Chefoo Convention made with China in 1876 has never been ratified, we are now reaping various advantages from its provisions. With the object of exploring South-Western China, and of watching the possibilities of the development of trade in these regions, it was arranged that an English Consular Agent was to reside at Chung-King in Sze-chuan on the upper waters of the Yang-tse. The officers who have held this post for the past six years have travelled widely through Yunnan, Sze-chuan, Kweichow, and other provinces, and have made most valuable contributions to the geography of China by the reports which have been published by them. Thus we have Mr. Colborne Baber's explorations in South-Western China published by the Royal Geographical Society, Mr. Parker's papers in the *China Review*, which we have already noticed, and now Mr. Hosie has made two reports, which have recently been published as Parliamentary Papers. The last of these deals with a journey of nearly 2000 miles from Chung-King to Chêng-tu, the provincial capital of Sze-chuan, thence by Tali in Yunnan to Yunnan-Fu, the capital of this province, returning to Chung-King by another route. The traveller does not think much of the European maps of these districts, for on p. 58 we find him complaining that "the number of mistakes in these maps, whether as regards boundary lines, names of places, &c., not to mention omissions, is truly alarming. As fairly accurate native maps are procurable, the occurrence of such mistakes as the above is astonishing." Mr. Hosie also gives some account of the aboriginal tribes, who usually avoid the frequented routes, as as they are afraid of being taken by the Chinese. He saw several Lolos, and a Si-fan or "tame wild man," as he is called by a kind of Hibernicism, as well as representatives of several other frontier tribes. There can be little doubt that in a short time, with these able and energetic English officers travelling far and wide from Chung-King as a centre, the geography of the south-western corner of China will be as well known to us as that of the districts adjoining the coast.

AT the opposite corner of the China Seas, another English officer, Consul-General Leys of Borneo, is endeavouring to promote the commercial development of little-visited districts in that wonderful island. He has recently visited the tracts watered by three considerable rivers flowing into Brunei Bay near Labuan, and hopes to get the Chinese merchants of the latter colony, as well as of Singapore, to send trading parties up these rivers. He further suggests the appointment of consular agents in the interior of the dominions of the Sultan of Brunei: a step which cannot fail largely to increase our knowledge of the geography and resources of Borneo.

THE December number of Guido Cora's *Cosmos*, which completes the first series (1873–1883) of that useful publication, contains the first part of Capt. C. F. Crema's journey to Morocco in connection with the Italian Mission under Commander Scovasso in 1882. The text, which gives us a graphic account of the progress of the mission from Tangiers through the maritime provinces southwards to the mouth of the Sebu in the Atlantic Ocean, is richly illustrated with numerous woodcuts from photographs and sketches taken by Crema himself. Some of the heads in these illustrations, such as those of Scovasso, the Kaid Raka, and the Arab Surgeon of Caria-ben-Auda, are capital studies of character and ethnical types. Others vividly reflect the salient aspects of the land, the architecture, and industries of its inhabitants. Conspicuous amongst these is the fine north-west gate of Shella near Rabat, which, with its two hexagonal towers, is the grandest monument of Moorish architecture still surviving in Morocco. The paper is also accompanied with a map to the scale of 1 : 750,000, which, being based on an accurate survey of the route, forms a valuable contribution to geographical exploration. It fills up many blank spaces, and gives numerous rectifications of existing maps, even in districts that have already been frequently visited by European travellers. In the same issue Gustavo Bianchi gives an account of his recent explorations in the Gurageh territory during the spring of the year 1880, accompanied by a useful map of the Galla country to the south and east of Shoa, which, with the exception of Cecchi and Chiarini's expedition in 1878, had been visited by no traveller since the time of Major Harris and d'Abbadie (1843–46).

THE *Boletin de la Sociedad Geografica di Madrid* for December 1883 has a paper by D. José Gomez San Juan, on the Spanish possessions in the Gulf of Guinea. The object of the writer is to establish the exclusive right of Spain to the islands of Annobon, Corisco, and the two Elobeis, as well as to the portion of the opposite mainland stretching from Punta del Campo to Punta Santa Clara on the right bank of the Gaboon. The paper is ably written, and contains much interesting historical and geographical information on the whole of the west coast of Africa from Sierra Leone to the equator.

THE German and Austrian Alpine Club now consists of no less than 100 sections. The last two sections formed were those at Bonn, on the Rhine, and at Schladming Radstadt in the Upper Enns Valley.

THE Stuttgart branch of the Berlin Centralverein für Handelsgeographie contemplates the establishment of a Museum for commercial geography at Stuttgart.

THERE will be several special exhibitions at Munich on the occasion of the fourth German Geographentag. The following are planned: (1) new maps and books; (2) curiosities of cartography and geographical literature; (3) Bavarian maps; (4) maps, reliefs, and books relating to the Alps; (5) maps, reliefs, atlases, and other objects suitable for instruction in geography; (6) work done by pupils in geography, to illustrate the methods of teaching.

LETTERS have been received from Herr Junker and from the Khartoum Consul, Herr Hansal, which, however, do not give satisfactory details about the traveller's doings during the last two years, nor about his present position. They are principally short notes dating from December 1882, August and October 1883, in which he refers to longer letters and reports, which have, however, not yet come to hand. Nevertheless, these notes prove that Junker was in good spirits and health in the Sennis Country at the beginning of October last, and far from being disheartened or disturbed by events in the Soudan, of which he knew, was fully occupied with his travels and the drawing of his maps.

DR. FINSCH of Bremen has now published the "Anthropological Results" of his journey to the Pacific, and they form a valuable addition to anthropological literature. The traveller does not solely rely upon his own researches and observations, but also upon his (according to Virchow) unexampled collection of plaster casts from the faces of living men and women, natives of the islands he visited. This collection consists of no less than 164 casts, and represents natives of sixty-one different islands; besides Polynesians, Micronesians, and Melanesians, it also contains Malays of the Indian Archipelago, for the sake of comparison. Copies of the casts will be a welcome means of instruction in anthropology, and can be obtained through Herr Louis Castan at Berlin (Panopticum).

AN expedition to the North Pole is being prepared by Capt. Fondacaro of the Italian navy. It is several centuries since an expedition to the North Pole was despatched from Italy.

THE SIX GATEWAYS OF KNOWLEDGE[1]

II.

THE sense of sight may be compared to the sense of sound in this respect. I spoke of the sense of sound being caused by rapid variations of pressure. I had better particularise and say how rapid must be the alternations from greatest pressure to least, and back to greatest, and how frequently must that period

---

[1] An Address at the Midland Institute, Birmingham, October 3, 1883, by Prof. Sir William Thomson, LL.D., F.R.S., president. Continued from p. 440.